

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:

Wright et al.

Serial No.: 10/731,774

Filed: December 8, 2003

For: APPARATUS AND METHOD FOR
REINFORCING A PRESSURE VESSEL

Confirmation No.: 4971

Examiner: S. Castellano

Group Art Unit: 3781

Attorney Docket No.: 2507-5738.2US
(21807-US-02)

**VIA ELECTRONIC FILING
APRIL 9, 2007**

APPEAL BRIEF

Mail Stop Appeal Brief – Patent
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sirs:

This brief is submitted in the format required under 37 C.F.R. § 41.37(c). The \$500.00 fee under 37 C.F.R. § 41.20(b)(2) for filing a brief in support of an appeal is submitted concurrently herewith.

1) REAL PARTY IN INTEREST

The real party in interest in the present pending appeal is Alliant Techsystems Inc., Assignee of the pending application as recorded with the United States Patent and Trademark Office on April 22, 2002, at Reel 012844, Frame 0944.

2) RELATED APPEALS AND INTERFERENCES

The Appellant, the Appellant's representative, and the Assignee are not aware of any pending appeal or interference that would relate to, directly affect, be directly affected by, or have a bearing on the Board's decision in the pending appeal.

3) STATUS OF THE CLAIMS

Claims 1 through 43 are pending in the application.

Claims 1 through 43 stand rejected.

No claims are allowed.

Claims 1 through 43 are the subject of the pending appeal.

4) STATUS OF AMENDMENTS

No amendments have been proposed in the present application subsequent the final rejection mailed October 26, 2006

5) SUMMARY OF THE CLAIMED SUBJECT MATTER

Referring to FIGS. 1 through 4, and 10 of the as-filed application, the presently claimed invention is directed to a vessel 100, 1000 (independent claim 1) and to a reinforcing structure 1008 for a vessel (independent claim 16). Considering independent claim 1, the vessel 100, 1000 includes a vessel body 106, 112, 1002 having at least one surface 110, 116, 1004, 1006 which is curved about both a vessel body axis 105 and a second axis. *As-filed Application* at p. 9, ¶ [0035] and p. 16, ¶ [0061]. The vessel 100, 1000 also includes a reinforcing structure 1008. *See Id.* at p. 10, ¶¶ [0037]-[0038] and p. 9, ¶ [0061].

The reinforcing structure 1008 (as claimed both claim 1 and 16) includes a plurality of gore pieces 128, 130, 132, 302, 304, 306, 400, 1010, 1012. Each gore piece 128, 130, 132, 302, 304, 306, 400, 1010, 1012 includes a sheet of composite material including a first surface, a second opposing surface and a plurality of fibers 404, 406 extending substantially parallel to the first surface. *Id.* at pp. 10-12, ¶¶ [0038]-[0044]. Each gore piece 128, 130, 132, 302, 304, 306, 400, 1010, 1012 exhibits a first width at a first longitudinal location along its length and a second lesser width at a second longitudinal location along its length. *Id.* at p. 11, ¶¶ [0042]-[0043]. The first longitudinal location of each gore piece 128, 130, 132, 302, 304, 306, 400, 1010, 1012 is disposed at a first radial distance from the vessel body axis 105, and the second longitudinal location is disposed at a second lesser distance from the vessel body axis 105. At least a portion of the first surface of each gore piece is disposed over and conforms to at least a portion of the at least one surface of the vessel body 106, 112, 1002. *Id.* at p. 10, ¶ [0038].

In accordance with another embodiment of the presently claimed invention, as set forth in independent claim 25, a method for making a reinforcing structure 1008 for a vessel 100, 1000

having a vessel body 106, 112, 1002 with at least one surface which curves about both a vessel body axis 105 and a second axis is provided. *Id.* at p. 10, ¶ [0039]. The method includes forming a plurality of gore pieces 128, 130, 132, 302, 304, 306, 400, 1010, 1012 as a sheet of composite material having a first surface, a second opposing surface and a plurality of fibers 404, 406 extending substantially parallel to the first surface. *See Id.* at pp. 10-12, ¶¶ [0039], [0040], [0044]. Each gore piece 128, 130, 132, 302, 304, 306, 400, 1010, 1012 is defined to exhibit a length, a first width at a first longitudinal location along a length of each gore piece and a second lesser width at a second longitudinal location along the length of each gore piece. *Id.* at p. 11, ¶ [0042]-[0043]. At least a portion of the first surface of each gore piece is disposed on at least a portion of the at least one surface of the vessel body such that the first longitudinal location of each gore piece is disposed at a first distance from the vessel body axis 105 and the second longitudinal location of each gore piece is disposed at a second lesser distance from the vessel body axis. *Id.* at p. 10, ¶ [0038]. Conforming the at least a portion of the first surface of each gore piece to the at least a portion of the at least one surface of the vessel body. *Id.* at p. 12, ¶ [0046].

In accordance with yet another embodiment of the invention, as set forth in independent claim 32, a method for reinforcing a vessel having a vessel body with at least one surface which is curved about both a vessel body and a second axis is provided. *See Id.* at p. 12, ¶ [0045]. Referring to FIGS. 1, 3-4, 6-7, the method comprises providing a plurality of gore pieces 302, 304, 306, 400. Each gore piece includes a sheet of composite material having a first surface, a second opposing surface and a plurality of fibers 404, 406 extending substantially parallel to the first surface. *See Id.* at pp. 10-12, ¶¶ [0039],[0040], [0044]. Each gore piece exhibiting a first

width at a first longitudinal location along a length of each gore piece and a second lesser width at a second longitudinal location along the length of each gore piece. *Id.* at p. 11, ¶ [0042]. A gore body 300 is formed by disposing the plurality of gore pieces on the vessel body 106 at the at least one surface 110, 116 of the vessel body. The first longitudinal location of each gore piece is disposed at a first distance from the vessel body axis 105 and the second longitudinal location of each gore piece is disposed at a lesser second distance from the vessel body axis. *Id.* at p. 3-4, ¶ [0038]. At least a portion of the first surface of each gore piece is configured to be disposed upon and conform to at least a portion of the at least one surface of the vessel body *Id.* at p. 12, ¶ [0046], and overlap a portion of at least one of the plurality of gore pieces with a portion of at least one other of the plurality of gore pieces. *Id.* at pp. 13-15, ¶¶ [0051]-[0053].

6) GROUND OF REJECTION TO BE REVIEWED ON APPEAL

(A) Claims 1 through 9 and 12 through 31 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Elliot et al. (U.S. Patent No. 3,490,638) in view of Toth et al. (U.S. Patent No. 4,614,279).

(B) Claims 10, 11, and 32 through 43 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Elliot et al. (U.S. Patent No. 3,490,638) in view of Toth et al. (U.S. Patent No. 4,614,279) and Sneddon (U.S. Patent No. 5,653,358).

7) ARGUMENT

STANDARD OF PATENTABILITY UNDER 35 U.S.C. § 103(a)

Rejection of claims under 35 U.S.C. § 103(a) requires that the U.S. Patent and Trademark Office (the “Office”) must first establish a *prima facie* case of obviousness. M.P.E.P. § 2142. The standard for establishing a *prima facie* case of obviousness is set forth in M.P.E.P. 706.02(j) where it states:

To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant’s disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

“If the proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims *prima facie* obvious.” M.P.E.P. § 2143.01 (citing, *In re Ratti*, 270 F.2d 810, 123 USPQ 349 (CCPA 1959)). To provide a motivation or suggestion to combine, the prior art or the knowledge of a person of ordinary skill in the art must “suggest the desirability of the combination” or provide “an objective reason to combine the teachings of the references.” *Id.*

Additionally, although a prior art device “may be *capable* of being modified to [work] the way the [present invention] is claimed, there must be a suggestion or motivation in the reference to do so.” *Id.* (citing, *In re Mills*, 916 F.2d 680, 16 USPQ2d 1430 (Fed. Cir. 1990)), emphasis

added. Moreover, it is improper to combine references where the references teach away from combination. M.P.E.P. § 2145.

In view of these standards and the arguments set forth below, Appellant respectfully submits that the Office has not established a *prima facie* case of obviousness under 35 U.S.C. § 103(a).

A.1 PATENTABILITY OF CLAIMS 1 THROUGH 4, 8, 12 AND 13

In an Office Action mailed October 26, 2006, and made Final (hereinafter “the Final Action”), the Examiner rejected claims 1 through 4, 8, 12 and 13 under 35 U.S.C. 103(a) as being unpatentable over Elliot et al. (U.S. Patent No. 3,490,638 – hereinafter “Elliot”) in view of Toth et al. (U.S. Patent No. 4,614,279 – hereinafter “Toth”).

Independent claim 1 is directed to a vessel. The vessel of claim 1 comprises: a vessel body having at least one surface which is curved about both a vessel body axis and a second axis; and a reinforcing structure comprising a plurality of gore pieces, each gore piece comprising a sheet of composite material including a first surface, a second opposing surface and *a plurality of fibers extending substantially parallel to the first surface*, each gore piece exhibiting a first width at a first longitudinal location along a length of each gore piece and a second lesser width at a second longitudinal location along the length of each gore piece, wherein the first longitudinal location of each gore piece is disposed at a first radial distance from the vessel body axis, the second longitudinal location of each gore piece is disposed at a second lesser distance from the vessel body axis, and wherein at least a portion of the first surface of each gore piece is disposed over and conforms to at least a portion of the at least one surface of the vessel body.

In rejecting claim 1, the Examiner asserts that Elliot discloses a vessel, wherein “the vessel includes a reinforcing structure comprising a plurality of gore pieces (strip 26), each gore piece is a sheet of fiber reinforced resin matrix material (a composite material) and includes a first surface (inside surface), a second opposing surface (outside surface), each gore piece has the geometric relationship claimed with first width, second lesser width, first longitudinal location at a greater radial distance and a second longitudinal location at a lesser radial distance.” *Final Action* at p. 2.

The Examiner then cites Toth as teaching “a vessel with a vessel body (liner 12) with a reinforcing structure (reinforcement 14) disposed over and conforming to the entire surface of the vessel body.” *Id.* The Examiner also cites Toth as teaching “fibers oriented parallel to the inner (first) surface of the reinforcement 14.” *Id.* The Examiner states that it “would have been obvious to add an inner liner layer to provide a layer more compatible with the contents of the vessel” and that it “would have been obvious to reorient the fibers of Elliot from radial to a direction parallel to the inside surface of the reinforcement to better reduce tensile and hoop stress within the reinforcement.” *Id.* For the reasons discussed herein below, Appellants respectfully traverse this rejection.

The Proposed Combination of Elliot and Toth Fails to Teach or Suggest all of the Limitations of the Claimed Invention

As set forth above, claim 1 of the presently claimed invention includes a plurality of gore pieces, each gore piece comprising a sheet of composite material including a first surface, a

second opposing surface and *a plurality of fibers extending substantially parallel to the first surface.*

While the Examiner cites Elliot as disclosing a plurality of gore pieces, and Toth as disclosing a plurality of fibers “oriented parallel to the inner (first) surface of the reinforcement,” it is noted that Toth describes a structure formed of filament winding and not from individual gore pieces (or other individual components) wherein the individual pieces each have a plurality of fibers and arranged according to the recitations of claim 1.

Toth describes the construction of its vessel as such:

The reinforcement 14 is applied by conventional filament winding techniques which generally include the steps of training a continuous filament, such as a glass filament, composed of a number of ends of fibers, through a resin trough to impregnate the filament with a predetermined quantity of a liquid thermosetting resin and winding the filament on the liner in a helical pattern. The pattern covers the entire outer surface of the liner 12, including its cylindrical side wall 16 and its oblate ellipsoidal end portions 18.
Toth, col. 3, line 64 – col. 4, line 6.

The pressure vessel of Toth is thus constructed using conventional filament winding techniques which employ a “continuous filament.” Indeed, those of ordinary skill in the art would recognize that the continuous nature of the filament provides substantial hoop strength and resistance to tensile forces when provided in a filament wound composite pressure vessel. Such a construction is considerably different from a structure having a plurality of individual gore pieces, each gore piece including a plurality of fibers. Thus, neither Elliot nor Toth teach or suggest individual *gore pieces*, each gore piece comprising a sheet of composite material

including a first surface, a second opposing surface and *a plurality of fibers extending substantially parallel to the first surface.*

Since the combined references of Elliot and Toth fail to teach or suggest all of the limitations of claim 1, Appellants submit that the Examiner has failed to present a *prima facie* case of obviousness. Appellants, therefore, submit that claim 1 is allowable over Elliot in view of Toth.

There is a Lack of Motivation to Combine Elliot With Toth in the Manner Proposed by the Examiner

Appellants submit that there is a clear lack of motivation to combine Elliot with Toth in the manner proposed by the Examiner. As set forth in greater detail below, the Examiner's proposed combination of Elliot with Toth would change the principle of operation of Elliot. Additionally, there is nothing in the references to motivate or suggest the desirability of combining Elliot with Toth. Moreover, Elliot teaches away from Toth as well as from the presently claimed invention.

The Examiner's Proposed Combination of Elliot with Toth Would Change the Principle of Operation of Elliot.

As discussed above, "[i]f the proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims *prima facie* obvious. M.P.E.P. § 2143.01 (citing, *In re Ratti*, 270 F.2d 810, 123 USPQ 349). Elliot discloses a hollow, shell-type, deep

submergence vessel. Elliot states that “it is an important object of the present invention...to provide vessels capable of withstanding high *external* pressures.” *Elliot* at Col. 1, lines 45-47, emphasis added. To that objective, Elliot teaches the use of a plurality of radial-filament sphere segments or strips with the segments being constructed from initially flat panels of unidirectional filament-reinforced resin wherein all filaments are oriented *normal* to the panels’ respective inner and outer surfaces. *See, e.g., Id.* at Col. 1, lines 13-16; Col. 4, line 57-73; and FIGS. 2-6, 6a and 10. The normal orientation of the filaments appears to be a critical feature of Elliot’s vessel.

More specifically, Elliot teaches the following:

In a hollow spherical vessel subjected to external hydrostatic pressure over its entire surface, the external pressure is opposed by balanced circumferential stresses in the wall of the vessel, and any given element of such a body can thus be considered as being subjected to two perpendicular compressive stresses, both essentially parallel to the surface. The general equation for the circumferential stress in a spherical shell under external hydrostatic pressure is

$$(1) \quad \sigma = \frac{Pr}{2t}$$

where P is the unit pressure, r is the mean radius of the sphere, and t is the wall thickness of the shell. If, now, each such element of the shell body is composed of a unidirectional-filament slab in which *all the individual fibers are oriented substantially radially of the sphere* and thus *normal to the plane of application of the compressive stresses*, the fibers in each element of the shell body will be stressed in tension. Thus, *no buckling of the filaments can occur*, which obviates the requirement of a high degree of straightness in the fibers and effective lateral support by the resin. *It will be readily recognized that this is precisely opposite to the situation existing in conventional filament-wound spheres, where transverse*

buckling of the filament windings is resisted only by the lateral support provided by the resin. Id. at Col. 3, lines 31-56 (emphasis added).

Clearly, the orientation of the fibers normal to the plane of application, which is opposite that which is recited in claim 1 of the presently claimed invention, is a critical feature for the Elliot vessel.

The combination suggested by the Examiner of Elliot with Toth would require a substantial redesign of the strips 26 in Elliot in reorienting the fibers from a radial orientation to an orientation wherein the fibers are “extending substantially parallel to the first surface,” as recited in claim 1. Such a redesign requires a fundamental change in the basic principle of construction of Elliot’s vessel, particularly considering how such a vessel is designed to operate, namely as a vessel that is intended to withstand high *external* pressures. *A prima facie* obviousness rejection is not proper when “the suggested combination of references would require a substantial reconstruction and redesign of the elements shown in [Elliot] as well as a change in the basic principle under which [Elliot’s] construction was designed to operate.” M.P.E.P. § 2143.01 (citing *In Re Ratti*, 270 F.2d at 813, 123 USPQ at 352).

Appellants, therefore, submit that the Examiner has not presented a *prima facie* case of obviousness with regard to the rejection of claim 1 based on his proposed combination of Elliot and Toth. As such, Appellants respectfully submit that claim 1 is allowable over Elliot in view of Toth.

There is Nothing in the References to Motivate or Suggest the Desirability of Making the Combination of Elliot with Toth.

There must be “something in the prior art as a whole to suggest the *desirability*, and thus the obviousness, of making the combination” of cited references. M.P.E.P. § 2143.01. As discussed above, Elliot discloses a hollow, shell-type, deep submergence vessel constructed to withstand high *external* pressures made of resin reinforced by filaments extending substantially normal to the inner and outer surfaces. *See Elliot* at Col. 1, lines 13-16 and lines 45-47. Toth, on the other hand, is directed to a filament wound plastic pressure vessel subject to high *internal* pressures. *Toth* at Col. 1, lines 7-10. There is no suggestion in Elliot or Toth of any desirability to combine specific components of a vessel having high compressive strength and that is specifically directed to being capable of withstanding high external pressures, as taught by Elliot, with components of a vessel directed to withstanding internal pressures, as taught by Toth. This is particularly so when the components proposed for replacement are the very components that enable the first vessel to withstand high external pressures.

Additionally, the mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggest the desirability of the combination. M.P.E.P. § 2143.01 (citing, *In re Mills*, 916 F.2d 680, 16 USPQ2d 1430 (Fed. Cir. 1990)). Similarly, although a prior art device “may be *capable* of being modified to [work] the way the [present invention] is claimed, there must be a suggestion or motivation in the reference to do so.” *Id.*, emphasis added.

It is briefly noted that, in *In re Mills*, as cited in M.P.E.P. § 2143.01, the claims were directed to an apparatus for producing an aerated cementitious composition by drawing air into

the cementitious composition by driving the output pump at a capacity greater than the feed rate.

The prior art reference taught that the feed means could be operated at a variable speed. The court, however, found that such a teaching did not require that the output pump be run at the claimed speed so that air is drawn into the mixing chamber and entrained as required by the claimed invention. *Id.*

In the present case, Elliot teaches the use of a plurality of radial-filament sphere segments or strips with the segments being constructed from initially flat panels of unidirectional filament-reinforced resin wherein all filaments are oriented *normal* to the panels' respective inner and outer surfaces. *See, e.g., Id.* at Col. 1, lines 13-16. Appellants submit that there is simply no suggestion in Elliot or Toth to modify the vessel described by Elliot by reorienting the filaments to extend "substantially parallel to the first surface" as recited in claim 1.

Rather, Appellants submit that such a suggestion can only be found by using improper hindsight. In fact, the only apparent, objective reason for modifying Elliot in the manner proposed by the Examiner is the description of the presently claimed invention set forth in Appellant's specification. Without the teachings found in Appellant's specification and claims, Appellants submit that a person of ordinary skill in the art would not combine Elliot with Toth in the manner proposed by the Examiner to arrive at the presently claimed invention. Thus, Appellant's submit that the Examiner has not presented a *prima facie* case of obviousness because there is a lack of motivation to combine Elliot and Toth in the manner proposed by the Examiner. As such, Appellants submit that claim 1 is allowable over Elliot in view of Toth.

The Combination of Elliot and Toth is Improper Because the References Teach Away from Their Combination.

It is improper to combine references where the references teach away from their combination. M.P.E.P. § 2145 (citing *In re Grasselli*, 713 F.2d 731, 743, 218 USPQ 769, 779 (Fed. Cir. 1983)). As explained above, claim 1 recites, in part, “a plurality of fibers extending substantially parallel to the first surface.” Elliot, however, teaches the use of filaments extending substantially normal or perpendicular to the inner and outer surfaces. *Elliot* at Col. 1, lines 13-16. This teaching in Elliot is a necessary feature in order to provide a vessel “capable of withstanding high external pressures.” *Id.* at Col. 1, lines 46-47. Elliot further states that this is necessary in order to provide a shell body where no buckling of the filaments will occur. *See Id.* at Col. 3, lines 49-50. Such a teaching is in direct contrast with Toth wherein the continuous filament winding is oriented substantially parallel with an inner surface with the resultant reinforcement structure. Similarly, such a teaching is in direct contrast with claim 1 of the presently claimed invention.

In other words, any modification of Elliot’s panels to include filaments oriented substantially *parallel* to their respective panel’s inner and outer surfaces would result in a vessel that is unable to withstand any substantial external hydrostatic pressure applied over the surface of the vessel. Such a configuration would likely result in the buckling of the vessel under any substantial external pressure, thereby rendering the Elliot vessel inadequate for its intended purpose, if not inoperable.

Because Elliot teaches away from being combined with Toth in the manner proposed by the Examiner, Appellants assert that there is a clear lack of motivation to combine the references

and, therefore the obviousness rejection is improper. Appellants, therefore, submit that claim 1 is allowable over Elliot in view of Toth.

There is not a Reasonable Expectation of Success in Combining Elliot with Toth

Appellants submit that there is no reasonable expectation of success in combining Elliot with Toth in the manner proposed by the Examiner. As previously noted, and as set forth by Elliot, transverse buckling of conventional filament-wound spheres (wherein the filament windings are substantially parallel to the surface of the structure) is “resisted only by the lateral support provided by the resin.” (Col. 3, lines 55-56). As such, one of ordinary skill in the art would not predict a reasonable expectation of success in combining Elliot and Toth in the manner proposed by the Examiner.

As such, Applicants again submit that the Examiner has failed to present a *prima facie* case of obviousness based on the proposed combination of Elliot and Toth. For this additional reason, Appellants submit that claim 1 is allowable over Elliot in view of Toth.

Because Elliot and Toth fail to teach or suggest all of the limitations of the presently claimed invention, because there is a clear lack of motivation to combine Elliot and Toth in the manner proposed by the Examiner, and because there is no reasonable expectation of success in the combination of Elliot and Toth as proposed by the Examiner, Appellants respectfully assert that independent claim 1 is allowable over Elliot and Toth.

Appellants also assert that claims 2 through 4, 8, 9, 12 and 13 are also allowable at least by virtue of their dependency from an allowable base claim.

A.2 PATENTABILITY OF CLAIMS 5 THROUGH 7

In the Final Action, the Examiner rejected claims 5 through 7 under 35 U.S.C. 103(a) as being unpatentable over Elliot in view of Toth. Appellants respectfully traverse this rejection.

Claim 5 depends from claim 1 and introduces the additional subject matter of the plurality of fibers of each gore piece being oriented in a plus/minus configuration relative to a longitudinal axis along the length of the respective gore piece. Claims 6 and 7 further depend from claim 5.

Appellants submit that one of ordinary skill in the art would not be motivated to orient the plurality of fibers in a plus/minus configuration relative to a longitudinal axis along the length of the respective gore piece. As noted by Elliot, in order to withstand substantial external hydrostatic pressures, the filaments of Elliot's panels are parallel to each other, *See, e.g., Elliot* at Col. 4, lines 64-65, and thus would each exhibit a similar orientation relative to a longitudinal axis of the panel. Modification of such would render the Elliot vessel inadequate for its intended purpose since the orientation of the filaments is deemed to be important, if not critical, to the proper operation of the vessel.

Appellants, therefore, submit that claims 5 through 7 are allowable over Elliot and Toth as being dependent from an allowable base claim as well as for the additional patentable subject matter introduced thereby.

A.3 PATENTABILITY OF CLAIM 9

In the Final Action, the Examiner rejected claim 9 under U.S.C. 103(a) as being unpatentable over Elliot in view of Toth. Appellants respectfully traverse this rejection.

Claim 9 depends from claim 1 via intervening claim 5 and introduces the additional subject matter of at least some of the plurality of fibers being configured to effectively intersect one another and define a space configured substantially as a rhombic section.

Appellants submit that one of ordinary skill in the art would not be motivated to orient at least some of the plurality of fibers to effectively intersect one another and define a space configured substantially as a rhombic section. As noted by Elliot, in order to withstand substantial external hydrostatic pressures, the filaments of Elliot's panels are parallel to each other, *See, e.g., Id.* at Col. 4, lines 64-65, and thus would not intersect each other to define such a configuration. Modification of such would render the Elliot vessel inadequate for its intended purpose since the orientation of the filaments is deemed to be important, if not critical, to the proper operation of the vessel.

Appellants, therefore, submit that claim 9 is allowable over Elliot and Toth as being dependent from an allowable base claim, an allowable intervening claim (i.e., claim 5), and for the additional patentable subject matter introduced thereby.

A.4 PATENTABILITY OF CLAIMS 14 AND 15

In the Final Action, the Examiner rejected claims 14 and 15 under 35 U.S.C. 103(a) as being unpatentable over Elliot in view of Toth. Appellants respectfully traverse this rejection.

Claim 14 depends from claim 1 and introduces the additional subject matter of a longitudinal axis along the length of each gore piece being offset with respect to the vessel body axis at an angle of between about +15° and -15°.

Claim 15 depends from claim 1 and introduces the additional subject matter of a longitudinal axis along the length of each gore piece being offset with respect to the vessel body axis at an angle of about 20° or less.

Appellants submit that Elliot and Toth fail to teach or suggest gore pieces, configured as set forth in claim 1 of the presently claimed invention, wherein a longitudinal axis along the length of each gore piece is offset with respect to the vessel body axis. Rather, all of the panels of Elliot appear to be oriented with longitudinal axes which are parallel with the vessel body axis. Furthermore, Appellants submit that Toth does not teach or suggest such subject matter.

Appellants, therefore, submit that claims 14 and 15 are allowable over Elliot and Toth as being dependent from an allowable base claim as well as for the additional patentable subject matter introduced thereby.

A.5 PATENTABILITY OF CLAIMS 16 THROUGH 19 AND 24

In the Final Action, the Examiner rejected claims 16 through 19 and 24 under 35 U.S.C. 103(a) as being unpatentable over Elliot in view of Toth. Appellants respectfully traverse this rejection.

Independent claim 16 is directed to a reinforcing structure for a vessel having a vessel body with at least one surface which is curved about both a vessel body axis and a second axis. The reinforcing structure comprises: a plurality of gore pieces, each gore piece of the plurality comprising a sheet of composite material including a first surface, a second opposing surface *and a plurality of fibers extending substantially parallel to the first surface*, each gore piece

exhibiting a first width at a first longitudinal location along a length of each gore piece and a second lesser width at a second longitudinal location along the length of each gore piece, wherein the first longitudinal location of each gore piece is configured to be disposed at a first radial distance from the vessel body axis and wherein the second longitudinal location of each gore piece is configured to be disposed at a second lesser radial distance from the vessel body axis, and wherein at least a portion of the first surface of each gore piece is disposed over and conforms to at least a portion of the at least one surface of the vessel body.

The Examiner relies upon Elliot and Toth as applied to claim 1 and as set forth hereinabove in section 7(A.1). For the reasons discussed herein below, Appellants respectfully traverse this rejection.

Neither Elliot nor Toth teach or suggest all of the limitations of claim 16 of the presently claimed invention. As detailed in section 7(A.1) above, the pressure vessel of Toth is constructed using conventional filament winding techniques which include a continuous filament. Such a construction, is considerably different from a structure having a plurality of individual gore pieces, each gore piece including a plurality of fibers. Thus, neither Elliot nor Toth teach or suggest individual *gore pieces, each gore piece comprising a sheet of composite material including a first surface, a second opposing surface and a plurality of fibers extending substantially parallel to the first surface.*

As also discussed above, the combination of Elliot with Toth would require a substantial redesign of the strips 26 in Elliot to reorient the fibers from radial orientation to an orientation wherein they are “extending substantially parallel to the first surface,” as recited in claim 16. Such a redesign requires a fundamental change in the basic principle under which the

construction of Elliot's vessel was designed to operate, namely as a vessel configured to withstand high external pressures. A *prima facie* obviousness rejection is not proper when "the suggested combination of references would require a substantial reconstruction and redesign of the elements shown in [Elliot] as well as a change in the basic principle under which [Elliot's] construction was designed to operate." M.P.E.P. § 2143.01 (citing *In Re Ratti*, 270 F.2d at 813, 123 USPQ at 352).

Additionally, there is nothing in the references relied upon by the Examiner to motivate or suggest the desirability of making the combination of Elliot with Toth. For example, there is no suggestion in Elliot or Toth of any desirability to combine a vessel specifically directed to being capable of withstanding high external pressures with high compressive strength, as taught by Elliot, with a vessel directed to withstanding internal pressures, as taught by Toth.

As previously discussed, the mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggest the desirability of the combination. M.P.E.P. § 2143.01. Without the teachings found in Appellant's specification and claims, a person of skill in the art would not combine Elliot with Toth.

Lastly, Elliot teaches away from being combined with Toth and away from the presently claimed invention. Elliot teaches that the use of filaments extending radially, or substantially normal to the inner and outer surfaces, is a necessary feature in order to provide a vessel "capable of withstanding high external pressures." *Elliot* at Col. 1, lines 46-47. This teaching in Elliot is a necessary feature in order to provide a vessel "capable of withstanding high external pressures." *Id.* at Col. 1, lines 46-47. Elliot further states that this is necessary in order to provide a shell body where no buckling of the filaments will occur. *See Id.* at Col. 3, lines 49-50. Such a

teaching is in direct contrast with Toth wherein the continuous filament winding is oriented substantially parallel with an inner surface with the resultant reinforcement structure. Similarly, such a teaching is in direct contrast with claim 16 of the presently claimed invention.

In other words, any modification of Elliot's panels to include filaments oriented substantially *parallel* to their respective panel's inner and outer surfaces would result in a vessel that is unable to withstand any substantial external hydrostatic pressure applied over the surface of the vessel. Such a configuration would likely result in the buckling of the vessel under any substantial external pressure, thereby rendering the Elliot vessel inadequate for its intended purpose, if not inoperable. Thus, Elliot clearly teaches away from combining Elliot with Toth. Likewise, Elliot teaches away from the presently claimed invention.

Appellants, therefore, assert that the Examiner has failed to present a *prima facie* case of obviousness based on the combination of Elliot and Toth, and that claim 16 is in condition for allowance.

Appellants further submit that claims 17 through 19 and 24 are allowable at least by virtue of their dependency from an allowable base claim.

A.6 PATENTABILITY OF CLAIMS 20 THROUGH 22

In the Final Action, the Examiner rejected claims 20 through 22 under 35 U.S.C. 103(a) as being unpatentable over Elliot in view of Toth. Appellants respectfully traverse this rejection.

Claim 20 depends from claim 16 and introduces the additional subject matter of the plurality of fibers of each gore piece being oriented in a plus/minus configuration relative to a

longitudinal axis along the length of each gore piece. Claims 21 and 22 further depend from claim 20.

Appellants submit that one of ordinary skill in the art would not be motivated to orient the plurality of fibers in a plus/minus configuration relative to a longitudinal axis along the length of the respective gore piece. As noted by Elliot, in order to withstand substantial external hydrostatic pressures, the filaments of Elliot's panels are parallel to each other (see, e.g., col. 4, lines 64-65) and thus would each exhibit a similar orientation relative to a longitudinal axis of the panel. Such a modification would render the Elliot vessel inadequate for its intended purpose since the orientation of the filaments is deemed to be important, if not critical, to the proper operation of the vessel.

Appellants, therefore, submit that claims 20 through 22 are allowable over Elliot and Toth as being dependent from an allowable base claim as well as for the additional patentable subject matter introduced thereby.

A.7 PATENTABILITY OF CLAIM 23

In the Final Action, the Examiner rejected claim 23 under U.S.C. 103(a) as being unpatentable over Elliot in view of Toth. Appellants respectfully traverse this rejection.

Claim 23 depends from claim 16 via intervening claim 20 and introduces the additional subject matter of at least some of the plurality of fibers being configured to effectively intersect one another and define a space configured substantially as a rhombic section.

Appellants submit that one of ordinary skill in the art would not be motivated to orient at least some of the plurality of fibers to effectively intersect one another and define a space

configured substantially as a rhombic section. As noted by Elliot, in order to withstand substantial external hydrostatic pressures, the filaments of Elliot's panels are parallel to each other (see, e.g., col. 4, lines 64-65) and thus would not intersect each other to define such a configuration. Modification of such would render the Elliot vessel inadequate for its intended purpose since the orientation of the filaments is deemed to be important, if not critical, to the proper operation of the vessel.

Appellants, therefore, submit that claim 23 is allowable over Elliot and Toth as being dependent from an allowable base claim, an allowable intervening claim (i.e., claim 20), and for the additional patentable subject matter introduced thereby.

A.8 PATENTABILITY OF CLAIMS 25, 28, 30 AND 31

In the Final Action, the Examiner rejected claims 25, 28, 30 and 31 under U.S.C. 103(a) as being unpatentable over Elliot in view of Toth. Appellants respectfully traverse this rejection.

Independent claim 25 of the presently claimed invention is directed to a method for making a reinforcing structure for a vessel having a vessel body with at least one surface which curves about both a vessel body axis and a second axis. The method comprises: forming a plurality of gore pieces for disposition on the at least one surface of the vessel body including *forming each of the plurality of gore pieces as a sheet of composite material having a first surface, a second opposing surface and a plurality of fibers extending substantially parallel to the first surface*; defining each gore piece to exhibit a length, a first width at a first longitudinal location along a length of each gore piece and a second lesser width at a second longitudinal location along the length of each gore piece; disposing at least a portion of the first surface of

each gore piece on at least a portion of the at least one surface of the vessel body such that the first longitudinal location of each gore piece is disposed at a first distance from the vessel body axis and the second longitudinal location of each gore piece is disposed at a second lesser distance from the vessel body axis; and conforming the at least a portion of the first surface of each gore piece to the at least a portion of the at least one surface of the vessel body.

The Examiner relies upon Elliot and Toth as applied to claim 1 and as set forth hereinabove in section 7(A.1). For the reasons discussed herein below, Appellants respectfully traverse this rejection.

Neither Elliot nor Toth teach or suggest all of the limitations of claim 16 of the presently claimed invention. As detailed in section 7(A.1) above, the pressure vessel of Toth is constructed using conventional filament winding techniques which include a continuous filament. Such a construction, is considerably different from a structure having a plurality of individual gore pieces, each gore piece including a plurality of fibers. Thus, neither Elliot nor Toth teach or suggest forming individual *gore pieces*, with *each gore piece comprising* a sheet of composite material including a first surface, a second opposing surface and *a plurality of fibers extending substantially parallel to the first surface*.

As also discussed above, the combination of Elliot with Toth would require a substantial redesign of the strips 26 in Elliot to reorient the fibers from radial orientation to an orientation wherein they are “extending substantially parallel to the first surface,” as recited in claim 16. Such a redesign requires a fundamental change in the basic principle under which the construction of Elliot’s vessel was designed to operate, namely as a vessel configured to withstand high external pressures. *A prima facie* obviousness rejection is not proper when “the

suggested combination of references would require a substantial reconstruction and redesign of the elements shown in [Elliot] as well as a change in the basic principle under which [Elliot's] construction was designed to operate.” M.P.E.P. § 2143.01 (citing *In Re Ratti*, 270 F.2d at 813, 123 USPQ at 352).

Additionally, there is nothing in the references relied upon by the Examiner to motivate or suggest the desirability of making the combination of Elliot with Toth. For example, there is no suggestion in Elliot or Toth of any desirability to combine a vessel specifically directed to being capable of withstanding high external pressures with high compressive strength, as taught by Elliot, with a vessel directed to withstanding internal pressures, as taught by Toth.

As previously discussed, the mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggest the desirability of the combination. M.P.E.P. § 2143.01 Without the teachings found in Appellant's specification and claims, a person of skill in the art would not combine Elliot with Toth.

Lastly, Elliot teaches away from being combined with Toth and away from the presently claimed invention. Elliot teaches that the use of filaments extending radially, or substantially normal to the inner and outer surfaces, is a necessary feature in order to provide a vessel “capable of withstanding high external pressures.” *Elliot* at Col. 1, lines 46-47. This teaching in Elliot is a necessary feature in order to provide a vessel “capable of withstanding high external pressures.” *Id.* at Col. 1, lines 46-47. Elliot further states that this is necessary in order to provide a shell body where no buckling of the filaments will occur. *See Id.* at Col. 3, lines 49-50. Such a teaching is in direct contrast with Toth wherein the continuous filament winding is oriented

substantially parallel with an inner surface with the resultant reinforcement structure. Similarly, such a teaching is in direct contrast with claim 16 of the presently claimed invention.

In other words, any modification of Elliot's panels to include filaments oriented substantially *parallel* to their respective panel's inner and outer surfaces would result in a vessel that is unable to withstand any substantial external hydrostatic pressure applied over the surface of the vessel. Such a configuration would likely result in the buckling of the vessel under any substantial external pressure, thereby rendering the Elliot vessel inadequate for its intended purpose, if not inoperable. Thus, Elliot clearly teaches away from combining Elliot with Toth. Furthermore, Elliot teaches away from the presently claimed invention.

Appellants, therefore, assert that the Examiner has failed to present a *prima facie* case of obviousness based on the combination of Elliot and Toth, and that claim 16 is in condition for allowance.

Appellants further submit that claims 17 through 19 and 24 are allowable at least by virtue of their dependency from an allowable base claim.

A.9 PATENTABILITY OF CLAIMS 26 AND 27

In the Final Action, the Examiner rejected claims 26 and 27 under 35 U.S.C. 103(a) as being unpatentable over Elliot in view of Toth. Appellants respectfully traverse this rejection.

Claim 26 depends from claim 25 and introduces the additional subject matter of orienting the plurality of fibers in a plus/minus configuration relative to a longitudinal axis along the length of each of the gore pieces at a fiber angle of between about 30° and 60°. Claim 27 further depends from claim 26 and provides the limitation of orienting the fibers at angle of about 45°.

Appellants submit that one of ordinary skill in the art would not be motivated to orient the plurality of fibers in a plus/minus configuration relative to a longitudinal axis along the length of the respective gore piece. As noted by Elliot, in order to withstand substantial external hydrostatic pressures, the filaments of Elliot's panels are parallel to each other (see, e.g., col. 4, lines 64-65) and thus would each exhibit a similar orientation relative to a longitudinal axis of the panel. Modification of such would render the Elliot vessel inadequate for its intended purpose since the orientation of the filaments is deemed to be important, if not critical, to the proper operation of the vessel.

Appellants, therefore, submit that claims 26 and 27 are allowable as being dependent from an allowable base claim as well as for the additional patentable subject matter introduced thereby.

A.10 PATENTABILITY OF CLAIM 29

In the Final Action, the Examiner rejected claim 29 under 35 U.S.C. 103(a) as being unpatentable over Elliot in view of Toth. Appellants respectfully traverse this rejection.

Claim 29 depends from claim 25 and includes the additional subject matter of orienting at least some of the plurality of fibers of each gore piece to effectively intersect and define a spaced configured substantially as a rhombic section.

Appellants submit that one of ordinary skill in the art would not be motivated to orient at least some of the plurality of fibers to effectively intersect one another and define a space configured substantially as a rhombic section. As noted by Elliot, in order to withstand substantial external hydrostatic pressures, the filaments of Elliot's panels are parallel to each

other (see, e.g., col. 4, lines 64-65) and thus would not intersect each other to define such a configuration. Modification of such would render the Elliot vessel inadequate for its intended purpose since the orientation of the filaments is deemed to be important, if not critical, to the proper operation of the vessel.

Appellants, therefore, submit that 29 are allowable as being dependent from an allowable base claim as well as for the additional patentable subject matter introduced thereby.

B.1 PATENTABILITY OF CLAIMS 10 AND 11

In the Final Action, the Examiner rejected claims 10 and 11 under 35 U.S.C. 103(a) as being unpatentable over Elliot in view of Toth and further in view of U.S Patent 5,653,358 to Sneddon (hereinafter "Sneddon"). Appellants respectfully traverse this rejection.

Claim 10 depends from independent claim 1. Claim 10 recites the additional subject matter of the vessel body comprising a first layer of gore pieces disposed around the at least one surface, and sequential ones of the first layer of gore pieces overlapping one another. Claim 11 depends from claim 10 and further recites that each of the first layer of gore pieces overlaps an adjacent first layer gore piece by about 40 to 60 percent.

The Examiner relies on Elliot and Toth as applied to claim 1, and then cites Sneddon as teaching "a reinforcement structure (outer jacket 16) constructed by superimposing and overlapping layers of impregnated filamentary material such as shown in FIGS. 2 and 3." The Examiner then states that it would have been obvious "to overlap the gore pieces over one another rather than to abut the gore pieces to insure that an inconsistency at the edge of a gore

piece doesn't result in an opening in the reinforcement structure which can leave a portion of the vessel body unprotected and unreinforced and could also result in stress concentrations leading to reinforcement structure stress cracks and ultimately catastrophic pressure vessel failure." *Final Action* at p. 4. For the reasons discussed herein below, Appellants respectfully traverse this rejection.

As previously discussed in detail in section 7(A.1), the Examiner has failed to present a *prima facie* case of obviousness with regard to claim 1 because the proposed combination of Elliot and Toth fails to teach or suggest all of the limitations of claim 1, there is a lack of motivation to combine the references in the manner proposed by the Examiner, and because there is no reasonable expectation of success in combining the cited references in the proposed manner.

Sneddon fails to remedy the shortcomings of Elliot and Toth in this regard.

Therefore, Appellants asserts that claims 10 and 11 are allowable at least by virtue of their dependency from an allowable base claim.

B.2 PATENTABILITY OF CLAIMS 32 THROUGH 34, 38 AND 40 THROUGH 43

In the Final Action, the Examiner rejected claims 32 through 34, 38 AND 40 through 43 under 35 U.S.C. 103(a) as being unpatentable over Elliot in view of Toth and further in view of Sneddon. Appellants respectfully traverse this rejection.

Independent claim 32 of the presently claimed invention is directed to a method for reinforcing a vessel having a vessel body with at least one surface which is curved about both a vessel body axis and a second axis. The method comprises: providing a plurality of gore pieces,

each gore piece comprising a sheet of composite material having a first surface, a second opposing surface and *a plurality of fibers extending substantially parallel to the first surface*, each gore piece exhibiting a first width at a first longitudinal location along a length of each gore piece and a second lesser width at a second longitudinal location along the length of each gore piece; forming a gore body including disposing the plurality of gore pieces on the vessel body at the at least one surface of the vessel body such that the first longitudinal location of each gore piece is disposed at a first distance from the vessel body axis and the second longitudinal location of each gore piece is disposed at a lesser second distance from the vessel body axis and such that at least a portion of the first surface of each gore piece is configured to be disposed upon and conform to at least a portion of the at least one surface of the vessel body; and overlapping a portion of at least one of the plurality of gore pieces with a portion of at least one other of the plurality of gore pieces.

The Examiner relies on the combination of Elliot and Toth as applied to claims 1, 16 and 25 and as discussed hereinabove. The Examiner further relies on Sneddon as teaching “a reinforcement structure (outer jacket 16) constructed by superimposing and overlapping layers of impregnated filamentary material such as shown in FIGS. 2 and 3.” The Examiner then states that it would have been obvious “to overlap the gore pieces over one another rather than to abut the gore pieces to insure that an inconsistency at the edge of a gore piece doesn’t result in an opening in the reinforcement structure which can leave a portion of the vessel body unprotected and unreinforced and could also result in stress concentrations leading to reinforcement structure stress cracks and ultimately catastrophic pressure vessel failure.” *Final Action* at p. 3. For the reasons discussed herein below, Appellants respectfully traverse this rejection.

The Examiner relies upon Elliot and Toth as applied to claim 1 and as set forth hereinabove in section 7(A.1). For the reasons discussed herein below, Appellants respectfully traverse this rejection.

Neither Elliot nor Toth teach or suggest all of the limitations of claim 16 of the presently claimed invention. As detailed in section 7(A.1) above, the pressure vessel of Toth is constructed using conventional filament winding techniques which include a continuous filament. Such a construction, is considerably different from a structure having a plurality of individual gore pieces, each gore piece including a plurality of fibers. Thus, neither Elliot nor Toth teach or suggest forming individual *gore pieces, each gore piece comprising* a sheet of composite material including a first surface, a second opposing surface and *a plurality of fibers extending substantially parallel to the first surface*.

As also discussed above, the combination of Elliot with Toth would require a substantial redesign of the strips 26 in Elliot to reorient the fibers from radial orientation to an orientation wherein they are “extending substantially parallel to the first surface,” as recited in claim 16. Such a redesign requires a fundamental change in the basic principle under which the construction of Elliot’s vessel was designed to operate, namely as a vessel configured to withstand high external pressures. *A prima facie* obviousness rejection is not proper when “the suggested combination of references would require a substantial reconstruction and redesign of the elements shown in [Elliot] as well as a change in the basic principle under which [Elliot’s] construction was designed to operate.” M.P.E.P. § 2143.01 (citing *In Re Ratti*, 270 F.2d at 813, 123 USPQ at 352).

Additionally, there is nothing in the references relied upon by the Examiner to motivate or suggest the desirability of making the combination of Elliot with Toth. For example, there is no suggestion in Elliot or Toth of any desirability to combine a vessel specifically directed to being capable of withstanding high external pressures with high compressive strength, as taught by Elliot, with a vessel directed to withstanding internal pressures, as taught by Toth.

As previously discussed, the mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggest the desirability of the combination. M.P.E.P. § 2143.01 Without the teachings found in Appellant's specification and claims, a person of skill in the art would not combine Elliot with Toth.

Lastly, Elliot teaches away from being combined with Toth and away from the presently claimed invention. Elliot teaches that the use of filaments extending radially, or substantially normal to the inner and outer surfaces, is a necessary feature in order to provide a vessel "capable of withstanding high external pressures." *Elliot* at Col. 1, lines 46-47. This teaching in Elliot is a necessary feature in order to provide a vessel "capable of withstanding high external pressures." *Id.* at Col. 1, lines 46-47. Elliot further states that this is necessary in order to provide a shell body where no buckling of the filaments will occur. *See Id.* at Col. 3, lines 49-50. Such a teaching is in direct contrast with Toth wherein the continuous filament winding is oriented substantially parallel with an inner surface with the resultant reinforcement structure. Similarly, such a teaching is in direct contrast with claim 16 of the presently claimed invention.

In other words, any modification of Elliot's panels to include filaments oriented substantially *parallel* to their respective panel's inner and outer surfaces would result in a vessel that is unable to withstand any substantial external hydrostatic pressure applied over the surface

of the vessel. Such a configuration would likely result in the buckling of the vessel under any substantial external pressure, thereby rendering the Elliot vessel inadequate for its intended purpose, if not inoperable. Thus, Elliot clearly teaches away from combining Elliot with Toth. Likewise, Elliot teaches away from the presently claimed invention.

Appellants, therefore, assert that the Examiner has failed to present a *prima facie* case of obviousness based on the combination of Elliot and Toth, and that claim 32 is in condition for allowance.

Appellants further submit that claims 33, 34, 38 and 40 through 43 are allowable at least by virtue of their dependency from an allowable base claim.

B.3 PATENTABILITY OF CLAIMS 35 THROUGH 37

In the Final Action, the Examiner rejected claims 35 through 37 under 35 U.S.C. 103(a) as being unpatentable over Elliot in view of Toth and further in view of Sneddon. Appellants respectfully traverse this rejection.

Claim 35 depends from claim 32 and introduces the additional subject matter of orienting the plurality of fibers in a plus/minus configuration relative to a longitudinal axis along the length of each of the gore pieces. Claims 36 and 37 further depend from claim 35 and provide the limitations of orienting the fibers at specified angles.

Appellants submit that one of ordinary skill in the art would not be motivated to orient the plurality of fibers in a plus/minus configuration relative to a longitudinal axis along the length of the respective gore piece. As noted by Elliot, in order to withstand substantial external hydrostatic pressures, the filaments of Elliot's panels are parallel to each other (see, e.g., col. 4,

lines 64-65) and thus would each exhibit a similar orientation relative to a longitudinal axis of the panel. Such a modification would render the Elliot vessel inadequate for its intended purpose since the orientation of the filaments is deemed to be important, if not critical, to the proper operation of the vessel.

Appellants, therefore, submit that claims 35 through 37 are allowable over Elliot, Toth and Sneddon based on their dependency from an allowable base claim as well as for the additional patentable subject matter introduced thereby.

B.4 PATENTABILITY OF CLAIM 39

In the Final Action, the Examiner rejected claim 39 under 35 U.S.C. 103(a) as being unpatentable over Elliot in view of Toth and further in view of Sneddon. Appellants respectfully traverse this rejection.

Claim 39 depends from claim 32 and introduces the additional subject matter of orienting at least some of the plurality of fibers of each gore piece to effectively intersect and define a space configured substantially as a rhombic section.

Appellants submit that one of ordinary skill in the art would not be motivated to orient at least some of the plurality of fibers to effectively intersect one another and define a space configured substantially as a rhombic section. As noted by Elliot, in order to withstand substantial external hydrostatic pressures, the filaments of Elliot's panels are parallel to each other (see, e.g., col. 4, lines 64-65) and thus would not intersect each other to define such a configuration. Modification of such would render the Elliot vessel inadequate for its intended

purpose since the orientation of the filaments is deemed to be important, if not critical, to the proper operation of the vessel.

Appellants, therefore, assert that claim 39 is allowable over Elliot, Toth and Sneddon based on its dependency from an allowable base claim as well as for the additional patentable subject matter introduced thereby.

8) CLAIMS APPENDIX

A copy of claims 1 through 43 is appended hereto as "Appendix A."

9) EVIDENCE APPENDIX

No evidence appendix is included herewith.

10) RELATED PROCEEDINGS APPENDIX

No related proceedings appendix is included herewith.

CONCLUSION

Appellants respectfully submit that claims 1 through 43 are allowable over the cited references of record. Appellant respectfully requests that the rejections of claims 1 through 43 under 35 U.S.C. § 103(a) be reversed.

Respectfully submitted,

A handwritten signature in black ink, appearing to read "Bradley B. Jensen", followed by a horizontal line.

Bradley B. Jensen
Registration No. 46,801
Attorney for Appellants
TRASKBRITT
P.O. Box 2550
Salt Lake City, Utah 84110-2550
Telephone: 801-532-1922

Date: April 9, 2007
BBJ/TJB/ps:dlm

Document in ProLaw

APPENDIX A

Claims 1-43

U.S. Patent Application No. 10/731,774

Filed December 8, 2003

1. A vessel comprising:
a vessel body having at least one surface which is curved about both a vessel body axis and a second axis; and
a reinforcing structure comprising a plurality of gore pieces, each gore piece comprising a sheet of composite material including a first surface, a second opposing surface and a plurality of fibers extending substantially parallel to the first surface, each gore piece exhibiting a first width at a first longitudinal location along a length of each gore piece and a second lesser width at a second longitudinal location along the length of each gore piece, wherein the first longitudinal location of each gore piece is disposed at a first radial distance from the vessel body axis, the second longitudinal location of each gore piece is disposed at a second lesser distance from the vessel body axis, and wherein at least a portion of the first surface of each gore piece is disposed over and conforms to at least a portion of the at least one surface of the vessel body.
2. The vessel as set forth in claim 1, wherein each gore piece comprises a preimpregnated fiber reinforced composite material.
3. The vessel as set forth in claim 1, wherein each gore piece comprises a bonding material to bond the plurality of gore pieces to one another.
4. The vessel as set forth in claim 3, wherein the bonding material comprises a resin.
5. The vessel as set forth in claim 1, wherein the plurality of fibers of each gore piece is oriented in a plus/minus configuration relative to a longitudinal axis along the length of the respective gore piece.
6. The vessel as set forth in claim 5, wherein the plurality of fibers in the plus/minus configuration of each gore piece is oriented at a fiber angle of between about 30° and 60° with respect to the longitudinal axis of the respective gore piece.

7. The vessel as set forth in claim 6, wherein the fiber angle is about 45°.
8. The vessel as set forth in claim 1, wherein each gore piece has a shape that comprises a substantially triangular section.
9. The vessel as set forth in claim 5, wherein at least some of the plurality of fibers are configured to effectively intersect one another and define a space configured substantially as a rhombic section.
10. A vessel as set forth in claim 1, wherein:
the vessel body comprises a first layer of gore pieces disposed around the at least one surface,
and sequential ones of the first layer of gore pieces overlap one another.
11. A vessel as recited in claim 10, wherein each of the first layer of gore pieces overlaps an adjacent first layer gore piece by about 40 to 60 percent.
12. A vessel as recited in claim 1, wherein the vessel body has a substantially uniform thickness.
13. The vessel as recited in claim 1, wherein the reinforcing structure has a substantially uniform thickness.
14. The vessel as recited in claim 1, wherein a longitudinal axis along the length of each gore piece is offset with respect to the vessel body axis at an angle of between about +15° and -15°.
15. The vessel as set forth in claim 1, wherein a longitudinal axis along the length of each gore piece is offset with respect to the vessel body axis at an angle of about 20° or less.

16. A reinforcing structure for a vessel having a vessel body with at least one surface which is curved about both a vessel body axis and a second axis, the reinforcing structure comprising:

a plurality of gore pieces, each gore piece of the plurality comprising a sheet of composite material including a first surface, a second opposing surface and a plurality of fibers extending substantially parallel to the first surface, each gore piece exhibiting a first width at a first longitudinal location along a length of each gore piece and a second lesser width at a second longitudinal location along the length of each gore piece, wherein the first longitudinal location of each gore piece is configured to be disposed at a first radial distance from the vessel body axis and wherein the second longitudinal location of each gore piece is configured to be disposed at a second lesser radial distance from the vessel body axis, and wherein at least a portion of the first surface of each gore piece is disposed over and conforms to at least a portion of the at least one surface of the vessel body.

17. The reinforcing structure as set forth in claim 16, wherein each gore piece comprises a preimpregnated fiber composite material.

18. The reinforcing structure as set forth in claim 16, wherein each gore piece comprises a bonding material to bond the plurality of gore pieces to one another.

19. The reinforcing structure as set forth in claim 18, wherein the bonding material comprises a resin.

20. The reinforcing structure as set forth in claim 16, wherein the plurality of fibers of each gore piece is oriented in a plus/minus configuration relative to a longitudinal axis along the length of each gore piece.

21. The reinforcing structure as set forth in claim 20, wherein the plurality of fibers in the plus/minus configuration of each gore piece is oriented at a fiber angle of between about 30° and 60° with respect to the longitudinal axis of each gore piece.

22. The reinforcing structure as set forth in claim 21, wherein the fiber angle is about 45°.

23. The reinforcing structure as set forth in claim 20, wherein at least some of the plurality of fibers are configured to effectively intersect one another and define a space configured substantially as a rhombic section.

24. The reinforcing structure as set forth in claim 16, wherein each of the plurality of gore pieces has a shape that comprises a substantially triangular section.

25. A method for making a reinforcing structure for a vessel having a vessel body with at least one surface which curves about both a vessel body axis and a second axis, the method comprising:
forming a plurality of gore pieces for disposition on the at least one surface of the vessel body including forming each of the plurality of gore pieces as a sheet of composite material having a first surface, a second opposing surface and a plurality of fibers extending substantially parallel to the first surface;
defining each gore piece to exhibit a length, a first width at a first longitudinal location along a length of each gore piece and a second lesser width at a second longitudinal location along the length of each gore piece;
disposing at least a portion of the first surface of each gore piece on at least a portion of the at least one surface of the vessel body such that the first longitudinal location of each gore piece is disposed at a first distance from the vessel body axis and the second longitudinal location of each gore piece is disposed at a second lesser distance from the vessel body axis; and

conforming the at least a portion of the first surface of each gore piece to the at least a portion of the at least one surface of the vessel body.

26. The method as set forth in claim 25, further including orienting the plurality of fibers in a plus/minus configuration relative to a longitudinal axis along the length of each of the gore pieces at a fiber angle of between about 30° and 60°.

27. The method as set forth in claim 26, further comprising orienting the plurality of fibers at a fiber angle of about 45°.

28. The method as set forth in claim 25, further including configuring each of the plurality of gore pieces as a substantially triangular section.

29. The method as set forth in claim 25, further comprising orienting at least some of the plurality of fibers of each gore piece to effectively intersect and define a space configured substantially as a rhombic section.

30. The method as set forth in claim 25, further including disposing a bonding material on each of the plurality of gore pieces.

31. The method as set forth in claim 30, wherein disposing a bonding material on each of the plurality of gore pieces further comprises disposing a resin on each of the plurality of gore pieces.

32. A method for reinforcing a vessel having a vessel body with at least one surface which is curved about both a vessel body and a second axis, the method comprising: providing a plurality of gore pieces, each gore piece comprising a sheet of composite material having a first surface, a second opposing surface and a plurality of fibers extending substantially parallel to the first surface, each gore piece exhibiting a first width at a first

longitudinal location along a length of each gore piece and a second lesser width at a second longitudinal location along the length of each gore piece;

forming a gore body including disposing the plurality of gore pieces on the vessel body at the at least one surface of the vessel body such that the first longitudinal location of each gore piece is disposed at a first distance from the vessel body axis and the second longitudinal location of each gore piece is disposed at a lesser second distance from the vessel body axis and such that at least a portion of the first surface of each gore piece is configured to be disposed upon and conform to at least a portion of the at least one surface of the vessel body; and

overlapping a portion of at least one of the plurality of gore pieces with a portion of at least one other of the plurality of gore pieces.

33. The method as set forth in claim 32, further comprising bonding the plurality of gore pieces to one another.

34. The method as set forth in claim 33, wherein bonding the plurality of gore pieces to one another further comprises at least partially curing a resin disposed on each of the plurality of gore pieces.

35. The method as set forth in claim 32, further comprising orienting the plurality of fibers in each gore piece in a plus/minus configuration relative to a longitudinal axis along the length of each gore piece.

36. The method as set forth in claim 35, further comprising orienting the plurality of fibers in the plus/minus configuration of each of the plurality of gore pieces at a fiber angle of between about 30° and 60° with respect to the longitudinal axis of each gore piece.

37. The method as set forth in claim 36, further comprising orienting the plurality of fibers in the plus/minus configuration of each gore piece at a fiber angle of about 45°.

38. The method as set forth in claim 32, further comprising shaping each gore piece as a substantially triangular section.

39. The method as set forth in claim 32, further comprising orienting at least some of the plurality of fibers of each gore piece to effectively intersect and define a space configured substantially as a rhombic section.

40. The method as set forth in claim 32, wherein the disposing the plurality of gore pieces includes disposing a first layer of the plurality of gore pieces around the at least one surface, and overlapping adjacent ones of the first layer of gore pieces on one another.

41. The method as recited in claim 40, wherein the overlapping further includes overlapping each of the first layer of gore pieces over an adjacent one of the first layer of gore pieces by about 40 to 60 percent.

42. The method as recited in claim 41, wherein the overlapping further includes overlapping each of the first layer of gore pieces over an adjacent one of the first layer of gore pieces by about 50 percent.

43. The method as recited in claim 32, wherein forming a gore body includes configuring the gore body to exhibit a substantially uniform thickness.